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## **STORM DRAINAGE - PLAN NOTES**

1. A pre-construction conference shall be held prior to the start of construction. The Contractor shall be responsible for securing all necessary permits prior to construction.
2. Before any construction may occur, the contractor shall have plans which have been signed and approved by the City of Kirkland Public Works Department, obtained all City, county, state, federal and other required permits, and have posted all required bonds.
3. All storm drainage improvements shall be designed and constructed in accordance with the latest edition of the City of Kirkland Public Works Pre-Approved Plans and Policies and the Standard Specifications for Road, Bridge and Municipal Construction, prepared by WSDOT and the American Public Works Association (APWA).
4. Any deviation from the approved plans will require written approval, all changes shall be submitted to the City.
5. A copy of the approved storm water plans must be on the job site whenever construction is in progress.
6. All disturbed areas shall be seeded and mulched or similarly stabilized to the satisfaction of the City of Kirkland Department of Public Works for the prevention of on-site erosion after the completion of construction.
7. Minimum cover over storm drainage pipes in ROW or vehicular path shall be 18 inches, unless other design is approved.
8. Steel pipe shall have Asphalt Treatment #1 or better inside and outside.
9. All catch basins shall be Type I unless otherwise noted. Catch basins with a depth of over five feet (5') to the pipe invert shall be a Type II catch basin. Type II catch basins exceeding five feet (5') in depth shall have a standard ladder installed.
10. All storm drainage main extensions within the public right-of-way or in easements must be staked for line and grade prior to starting construction.
11. Rock for erosion protection of roadway ditches, where required, must be of sound quarry rock, placed to a depth of one foot (1') and must meet the following specifications: 4"-8" rock/40%-70% passing; 2"-4" rock/30%-40% passing; 2"-minus rock/10%-20% passing.
12. All pipe, manholes, catch basins, and appurtenances shall be laid on a properly prepared foundation in accordance with the current State of Washington Standard specifications for road and bridge construction (WSDOT). This shall include necessary leveling of the trench bottom or the top of the foundation material as well as placement and compaction of required bedding material to uniform grade so that the entire length of the pipe will be supported on a uniformly dense, unyielding base. If the native material in the bottom of the trench meets the requirements for "gravel backfill for pipe bedding," the first lift of pipe bedding may be omitted provided the material in the bottom of the trench is loosened, regraded, and compacted to form a dense unyielding base. All pipe bedding shall be APWA Class B, Type I, or better. Pipe shall not be installed on sod, frozen earth, large boulders, or rock. Pipe bedding for flexible pipes shall be pea gravel to the springline of the pipe.

13. Construction of dewatering (groundwater) systems shall be in accordance with the APWA Standard Specifications.
14. Issuance of a Building or Land Surface Modification permit by the City of Kirkland does not relieve the owner of the continuing legal obligation and/or liability connected with storm surface water disposition. Further, the City of Kirkland does not accept any obligation for the proper functioning and maintenance of the system during or following construction except as outlined in the City of Kirkland Public Works Standards.
15. All trench backfill shall be compacted to 95 percent density in roadways, roadway shoulders, roadway prism and driveways, and 85 percent density in unpaved areas. All pipe zone compaction shall be 95 percent.
16. The Contractor shall be responsible for providing adequate safeguards, safety devices, protective equipment, confined space protection, flaggers, and any other needed actions to protect the life, health, and safety of the public, and to protect property in connection with the performance of work covered by the contract. Any work within the traveled right-of-way that may interrupt normal traffic flow shall require a Traffic Control Plan approved by the City of Kirkland. All sections of the WSDOT Standard Specifications, Traffic Control, and the Manual of Uniform Traffic Control Devices (MUTCD) shall apply.
17. No final cut or fill slope shall exceed slopes of two (2) horizontal to one (1) vertical without stabilization by rockery or by a structural retaining wall.
18. All manhole ladders shall be firmly attached and extend to within 1' of the bottom of the structure.
19. Approximate locations of existing utilities have been obtained from available records and are shown for convenience. The Contractor shall be responsible for verification of existing utility locations whether or not these utilities are shown on the plans. The Contractor shall exercise all care to avoid damage to any utility. If conflicts with existing utilities arise during construction, the contractor shall notify the City Construction Inspector and any changes required shall be approved by the Development Engineer prior to commencement of related construction on the project.
20. The underground utility location service shall be contacted for field location of existing utilities prior to any construction. The owner or his representative shall be contacted if a utility conflict exists. For utility location in King County, call 1-800-424-5555. The Contractor is responsible to ensure that utility locates are maintained throughout the life of the project.
21. The Contractor shall verify the locations, widths, thicknesses, and elevations of all existing pavements and structures that are to interface with new work. Provide all trimming, cutting, saw cutting, grading, leveling, sloping, coating, and other work, including materials as necessary, to cause the interface with existing works to be proper, acceptable to the Engineer and the City of Kirkland, complete in place and ready to use.
22. All inlet, manhole, and catch basin frames and grates shall not be adjusted to grade until immediately prior to final paving. All catch basin grates shall be set 0.10' below pavement level.

23. Open cut road crossings for utility trenches on existing traveled roadway shall be backfilled only with 5/8" minus crushed rock and mechanically compacted (unless otherwise approved by the City). For streets classified as arterials or collectors, backfill for crossings shall be CDF. Cuts into the existing asphalt shall be neat line cut with saw or jackhammer in a continuous line. A temporary cold mix patch must be placed immediately after backfill and compaction. A permanent hot mix patch shall be placed within 30 days and shall be a minimum of 1" thicker than the original asphalt with a minimum thickness of 2". See Standard D.02.
24. All damages incurred to public and/or private property by the contractor during the course of construction shall be promptly repaired to the satisfaction of the City Construction Inspector before project approval and/or the release of the project's performance bond.
25. Grout all seams and openings in all inlets, catch basins, and manholes. Jetset grout is NOT allowed.
26. When widening an existing roadway where an existing Type I catch basin will remain in the travel lane, the existing frame and cover shall be replaced with a round, locking frame and cover.
27. For other than single-family dwellings, all exposed or readily exposed indoor storm drainage piping/plumbing shall be labeled with the words "STORM DRAIN" with minimum 2 inch high letters.

## **STORM DRAINAGE - DESIGN CRITERIA**

### **I. DESIGN**

- A. To comply with the National Pollutant Discharge Elimination System (NPDES) municipal stormwater permit, Kirkland adopted the 2009 King County Surface Water Design Manual. All development proposals are required to comply with the design standards in this manual.

### **II. PIPE**

#### A. Materials

##### 1. Acceptable Types

##### a. Publicly owned and maintained conveyance systems

- i. PVC 3034
- ii. Ductile Iron
- iii. C900
- iv. HDPE for elevated (above ground) use only with approval from Public Works (not ADS N-12)

##### b. Privately owned and maintained conveyance systems, and Publicly and privately owned and maintained detention tanks

- i. PVC 3034
- ii. CPEP (ADS N-12 or equal)
- iii. Hancor High Q
- iv. Treatment 1 Steel
- v. Aluminum CMP: Pipe thickness shall be 0.060" (16 ga.) unless minimum bury cannot be obtained.
- vi. Concrete: Pipe must be steel reinforced type for sizes larger than 12" diameter.
- vii. Ductile Iron
- viii. C900

- 2. All Pipes shall have a minimum 18" of pipe cover in the ROW or private drives exposed to vehicular traffic. If pipe cover is less than 18 inches the pipe shall be ductile iron (Class 50) or C-900. Also, any pipes proposed to be installed in the load bearing zone of structural walls must be protected by a ductile iron (Class 50) sleeve. The design or use of DI sleeves must be approved by the City of Kirkland Department of Public Works.

3. Storm drainage pipes laid 16 feet and deeper must be cement lined, ductile iron pipe, Class 50.

B. Sizing

1. Size of the required pipe will be based on the Manning Equation with a minimum slope of 0.02 ft/ft for 6" pipe, 0.01 ft/ft for 8" pipe and 0.005 ft/ft for 12" pipe. Minimum velocity at full flow shall be 3.0 feet per second.
2. The following is a list of the minimum pipe diameter size for the listed pipe type:

a. Main Line	12"
b. Curb Inlet Crossing	8"
c. Side Line	6"
d. Sidewalk Drain Leader	4"
e. Perf Drain Line	6"
f. Rockery/Retaining Wall Drain	6"
3. Downstream pipe shall be the same size or larger than the upstream pipe.

C. Jointing

1. Aluminum CMP shall be band and gasket at all joints except in areas where a high water table problem exists.
2. Concrete pipe joints shall be rubber ring gasket.
3. PVC pipe shall be rubber gasket slide jointing.

D. Horizontal and Vertical Clearance

1. Minimum Horizontal Clearance between storm drainage, sanitary sewer, and water pipes shall be 5 feet, unless another design alternative has been specifically approved by the Development Engineer.
2. Minimum Vertical Clearance where storm drainage, sanitary sewers and water mains cross shall be 18 inches between the pipes, unless an alternative design has been specifically approved by the Development Engineer.

E. General

1. Bends are not allowed in main lines.
2. A catch basin is required for the following conditions:
  - a. A change in the flow-line slope.

- b. At a maximum distance of 300' in a main line.
  - c. A change in the pipe size.
  - d. For the jointing of two or more main lines.
  - e. For a side-line service.
  - f. A change in pipe-material type.
3. Tapping Tees are acceptable for side services where structures cannot be installed due to other structure conflicts, but only if a yard drain is located within 10' of the property line.
4. All driveway culverts located within City of Kirkland rights-of-way shall be of sufficient length to provide a minimum 3:1 slope from the edge of the driveway to the bottom of the ditch. Culverts shall have beveled end sections to match the side slope.
5. Public Storm drains are to be centered in easements with a minimum width of 15 feet or two times the depth of the utility, whichever is greater. Reduction of the easement width may be allowed on a case-by-case basis.
6. Drainage outlets (stub-outs) shall be provided for each individual lot, except for those lots approved for infiltration by City of Kirkland Department of Public Works. Stub-outs shall conform to the following:
- a. Each outlet shall be suitably located at the lowest elevation on the lot, so as to service all future roof downspouts, footing drains, driveways, yard drains, and any other surface or subsurface drains necessary to render the lots suitable for their intended use. Each outlet shall have free-flowing positive drainage to an approved storm water conveyance system or to an approved outfall location.
  - b. Outlets on each lot shall be located with a 5' high, white 2" x 4" stake marked "STORM" or "DRAIN." The stub-out shall visibly extend above surface level and be secured to the stake.
  - c. Pipe material shall conform to City of Kirkland standards.
  - d. Drainage easements are required for drainage systems designed to convey flows across more than one lot.
  - e. The Developer and/or Contractor is responsible for coordinating the locations of all stub-out conveyance lines with respect to the utilities (e.g., power, gas, telephone, television).
  - f. All individual stub-outs shall be privately owned and maintained by the respective property owner.
7. Building structures shall not be permitted within 10' of the outside of any storm drainage pipe, or 15' from the top of any channel bank.



8. All building downspouts, footing drains, and lot drains on commercial sites shall be connected to the storm drainage system, unless otherwise approved by the Department of Public Works.
9. Projects proposing to construct or replace onsite conveyance system elements that receive runoff from non-roof-top pollution generating impervious surface area must provide a spill control device as detailed in Section 4.2.1.1 of the 2009 King County Surface Water Design Manual prior to discharge from the site or into a natural onsite drainage feature. The intent of this device is to temporarily detain oil or other floatable pollutants before they enter the downstream drainage system in the event of an accidental spill or illegal dumping. It may consist of a tee section in a manhole or catch basin, or an equivalent alternative as specified in Section 4.2.1.1.

### III. CATCH BASINS/INLETS

#### A. Material

1. Shall be precast concrete steel reinforced construction.
2. Adjustment rings shall be precast concrete.
3. Grates and covers shall be ductile iron and frames shall be cast iron. Alternate plans are acceptable provided that they conform to shop drawings approved by the City of Kirkland. Covers shall be marked "STORM".

#### B. Sizing

1. Acceptable pipe sizes used with specific drainage structures shall conform to the following table:

**Table 1:** Pipe Sizes and Drainage Structures

Basin Type	Pipe Size								
	6"	8"	12"	15"	18"	24"	30"	36"	48"
Yard Drain	X								
Curb Inlet	X	X							
Type I CB	X	X	X	X					
Type I-L CB	X	X	X	X	X				
Type II-48" CB	X	X	X	X	X	X	X		
Type II-54" CB	X	X	X	X	X	X	X	X	
Type II-72" CB	X	X	X	X	X	X	X	X	X

2. Type II CB shall be used for all pipes larger than 18" and shall be sized at 1-1/2 times the largest connected pipe's diameter.

C. Depth

1. All catch basins with 5' or less between the top of grate and the pipe invert can be Type I CBs.
2. All catch basins with more than 5' between the top of grate and the pipe invert must be Type II CB's.

D. Spacing

1. For grades less than 8 percent, catch basin spacing shall be a maximum of 300 feet.
2. For grades from 8 to 12 percent, catch basin spacing shall be a maximum of 200 feet.
3. For grades greater than 12 percent, catch basin spacing shall be a maximum of 150 feet.

E. Grate Selection

1. Vaned or BI-Vaned grates only.
2. Through-curb frames with vaned grates shall be used for grade change points where the slope changes from a 6 percent or greater slope to a 2 percent or less slope.
3. Solid lids for Type II catch basins shall be round traffic-bearing and marked "STORM" or "DRAINAGE". Type I shall be traffic-bearing steel plates. Any solid lid in the public right-of-way shall be a round frame and cover that is referred to in the specifications.
4. All frame and covers shall be lockable with a standard 5/8" hex drive bolt (except Pamrex frame and cover).

F. Joints

1. Type I joints shall be non-shrink grout.
2. Type II and larger manholes shall have gasketed joints and shall be watertight sealed.
3. Concrete pipe and CMP pipe shall be joined to the catch basin with non-shrink grout between the pipe and the structure.
4. PVC and other plastic pipes require a coupling adapter made for the pipe type and concrete joining.

G. Construction

1. Catch basins shall be bedded in pea gravel when:
  - a. The catch basin is a Type II or larger manhole assembly.

- b. The placement is in a water table and the soil is unstable.
  - c. The base soils are over-excavated.
2. Adjustments over 2" to grade shall be with concrete adjustment rings. This should apply to all drawings.
  3. Adjustments under 2" shall be with concrete or non-shrink grout. This should apply to all drawings.
  4. For Type II CB's with eccentric cone top-section, the maximum adjustment distance is 12", not including casting.
  5. For Type II CB's with flat-top, the maximum adjustment distance is 12", not including casting.
  6. All connections to structures shall use sand collars with non-shrink grout (no Jet Set allowed).
  7. Wood, rock, expansion joint or red brick shall not be used at any time. If standard grey concrete 2"x4"x8" bricks are used they shall be totally encapsulated with concrete or grout. This should apply to all drawings.
  8. All adjustment risers shall be grouted down with non-shrink grout or some type of Portland and sand mixture. Dry stacking is not allowed.
  9. In City approved circumstances where paved access cannot be provided to a catch basin, the catch basin shall be within 50 ft of paved access and pedestrian access must be maintained, i.e., fences shall have gates, etc. If paved access cannot be provided within 50ft of a catch basin, then the catch basin shall not have a sump and shall be channeled. In cases where a channeled catch basin is used there must be a standard catch basin with paved access at least 200 ft upstream. In addition, the pipe slope downstream of the standard catch basin shall be 2% minimum.

#### H. Privately Owned Catch Basins, Area Drains, and Inlets.

1. Minimum size for a catch basin or area drain (small catch basin) is 12 inches in diameter with 18 inches between the invert of the outlet pipe and the bottom of the catch basin or area drain. If the minimum sump (water storage area) cannot be met, then the drainage device must be connected to a catch basin with at least the minimum sump and a floatable material separator before discharging the storm water to the public system.
2. Parking lots for three or more vehicles must have a catch basin to collect storm water.
3. All stormwater conveyance systems along Lake Washington shall pass through a structure, appropriate to the catch basin service area, with a floatable material separator, prior to discharging into the lake.
4. The service areas for all private Catch Basins and Area Drains shall conform to the following table:

<b>CATCH BASIN SERVICE AREAS</b> (This table does not apply to catch basins located in public streets)	
Catch Basin/Area Drain Size	Maximum Impervious Area Served
<u>Area/ Yard Drains</u> Yard Drain Standard Plan CK-D.05. The minimum sump is 1 foot in diameter and 18-inches-deep below the invert of the outlet pipe.	500 square feet
<u>Type 1 Catch Basins or Type 40</u> Catch Basin Standard Plan CK-D.07 or CK-D.05A. The sump is approximately 22 inches by 26 inches and 17 inches-deep below the outlet.	with a 4 inch outlet, 7,500 square feet with a 6 inch outlet, 15,000 square feet
<u>Type 2 Catch Basins</u> Catch Basin Standard Plan CK-D.09. The sump is a minimum of 4 feet in diameter and 2 feet deep below the outlet.	30,000 square feet